

**ENERGY SAVINGS OPPORTUNITY SURVEY  
FORT LESLIE J. MCNAIR, WASHINGTON, D.C.**

**A/E CONTRACT NO.  
DACA 31-89-C-0198**

**FINAL SUBMITTAL**

**VOLUME I  
EXECUTIVE SUMMARY**

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## **VOLUME I**

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## 1.0 INTRODUCTION

Fort McNair is a permanent United States Army installation located in southwest Washington, D.C. along the Washington Channel. It is the headquarters of the Military District of Washington as well as the National War College and Industrial College of the Armed Forces which form the National Defense University. The facility also contains family housing, barracks, a PX and a commissary.

The energy Savings Opportunity Survey (ESOS) for Fort McNair is a project to improve energy efficiency of the buildings by analyzing selected energy conservation opportunities (ECOs) indicated in the scope of work and making recommendations for any other ECO which may be applicable.

This project is funded under the National Energy Conservation Policy Act (NECPA). ESOS projects have the prime objective of evaluating energy conservation opportunities (ECOs) in quest of meeting the goals of the NECPA, the Army Energy Plan and the Department of Defense Energy Management Plan.

This study constitutes a pre-final submittal and includes the project criteria and the methodology used for conducting this analysis. The study also includes an ECIP analysis summary for each building.

Engineering services for this project are being provided by Engineering Applications Consultants, P.C. under Contract No. DACA 31-89-C-0198 for the Department of the Army, Baltimore District Corps of Engineers.

Significant assistance and cooperation has been provided by the Corps of Engineers and the user agency for this analysis. EAC wishes to extend special appreciation to Mrs. Joan A. Johnson, Mr. Ralph W. Gibson, Mr. Richard B. Rice and Mr. Hal C. Schramm for their assistance, and to Mr. James Hawk for his guidance, which has contributed to the development of this study.

## **2.0 PROJECT SUMMARY AND RECOMMENDATIONS**

This study contains the findings of the Energy Savings Opportunity Survey at Fort McNair, Washington, D.C., and is based on the field survey, discussions with the users and the operating personnel and the review of drawings whenever available. Volume I of this study contains an executive summary, Volume II contains the project criteria, methodology and building narrative. Volume III contains the programming documents. Volumes IV through VII contain calculations for all the ECOs considered.

Project criteria lists environmental conditions within the buildings and climatic data applicable to the project site. Included under project criteria are fuel rates, incentives offered by the Potomac Electric Power Company for implementing energy conservation opportunities, economic life of the improvements and discount factors.

The methodology section of this study contains a description of energy saving opportunities considered under this survey and the procedures for calculating the energy savings. The recommended ECOs have been prioritized by taking synergism into account.

An Energy Savings Opportunity Survey was conducted for building numbers 20, 31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61. In all buildings, except Building 20, ECO's pertaining to lighting were considered. The lighting ECOs have generally been categorized into two options. Option 1 contains an evaluation of lighting ECOs with standard forty watt lamps. Option 2 contains an evaluation of lighting ECO's with 34 watt energy saver lamps. The use of dimming devices reduces the fixture life. Therefore, ECOs for dimming have not been considered in Option 2. The inclusion of two options in this study will allow the post maximum flexibility for selecting these ECOs for packaging and their subsequent implementation.

The cost of lighting ECOs includes the incentives offered by PEPCO. The post should apply for these incentives immediately. Upon acceptance of the application, PEPCO will allocate funds for their implementation. This process, however, will not obligate the post to participate in the incentive program.

In calculating the cost of ECOs, cost of design has not been included. These ECO's can be implemented by the maintenance staff at the post. If the post decides the work to be done by a contractor, design cost should be included. The following is a summary of ECO's recommended for implementation. The programming documents for each option are included in Volume III.

#### OPTION 1

ECO DESCRIPTION	BUILDING NO.	COST	Quantity
		FY 1991	
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 9,054	516
Static Dimmers	31, 32, 35, 39, 40, 42, 46, 47, 48, 50, 52, 54, 56, 59, 60, and 61	\$ 32,494	37
Photo-Electric Dimmers	31, 32, 47, 48, 49 and 50	\$ 3,682	200
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 56, and 59	\$ 19,001	221

Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49 50, 52, 60, 59 and 61	\$ 24,574	658
Energy-Efficient Ballasts (Spot Replacement)	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$115,321	6818
Roof Insulation	42	\$ 4,599	-
Night Setback	48	\$ 15,687	-
Steam Convertor Insulation	59	\$ 570	-
TOTAL		\$224,982	-

#### OPTION 2

ECO DESCRIPTION	BUILDING NO.	COST FY 1991	Quantity
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 9,054	658
Energy Saver Lamps	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 86,609	11,737
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 56, and 59	\$ 21,580	251
Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49 52, 59, 60, and 61	\$ 24,699	201
Energy-Efficient Ballasts (Group Replacement)	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$328,895	6,818

Roof Insulation	42	\$ 4,599	-
Night Setback	48	\$ 15,687	-
Steam Convertor Insulation	59	\$ 570	-
<b>TOTAL</b>		<b>\$491,693</b>	<b>-</b>

Other lighting ECOs considered are replacing Mercury Vapor fixtures with Metal Halide fixtures and replacing fluorescent U-shaped lamps with energy efficient U-shaped lamps but are not recommended for implementation due to low SIR.

Building 20 currently has one #2 fuel oil boiler. An evaluation was made for conversion to natural gas. Because of low fuel oil cost and near replacement age of the boiler, the ECO is not feasible. The analysis shows a SIR of less than one for this conversion and is not recommended for implementation.

In building 42, energy usage was modeled by computer simulation. The building currently uses 117,949 btu/sq ft/yr. This energy consumption compares well with other federal buildings of similar size. In addition to the lighting ECO's listed above, the effectiveness of improving the roof insulation, solar film and chilled water reset were also considered. All ECO's except solar film and chilled water reset are being recommended for implementation. The night setback system associated with Building 42 offers a good potential for saving energy. This system is not in operation currently. A computer simulation shows that if this system were set in proper operation, it would result in energy savings of approximately 46,450 btu/sq ft/yr, resulting in a marked improvement in energy consumption.

In Buildings 42, 48, 59, and 61 steam systems were also surveyed. Usage of low pressure steam, regular program of trap repair, as well as the practice of cutting off the steam supply to these buildings during moderate weather, makes these systems quite efficient. The condition of the steam systems and maintenance are good. Repairing and setting the existing

indoor-outdoor reset systems in operation as part of the maintenance program is one of the recommendations.

Building 48 has been studied for its hydronic heat pump system. A computer simulation of this building calculated a total energy consumption of 64,468 but/sq ft/yr, indicating a very energy efficient building. The energy consumption can further be reduced by installing time clocks and occupancy sensors for night setback and set up. Occupancy sensors, however, have a very low SIR of 0.37.

Thermal Energy Storage (TES) was considered for Buildings 59 and 61. In Building 59 TES has a payback of 31 years and a negative payback in Building 61. This can be explained due to the fact that the existing chillers were installed approximately five years ago and are extremely energy efficient. The conversion of these chillers into thermal storage mode substantially increases kilowatts required per ton of cooling. Based on this analysis, it can be concluded that thermal storage is cost effective in new buildings or when the HVAC system in existing buildings is at the end of its useful life requiring replacement. In new buildings and during a complete retrofit of existing buildings, cost benefits result by downsizing the refrigeration plant and by downsizing the air distribution system by supplying cooler air. In these instances, the downsizing of the air conditioning equipment coupled with reduced demand charges may make the payback for thermal storage system attractive. In addition, diesel generators were also considered for peak shaving and load curtailment in both these buildings. Both approaches did not prove cost effective. It can be concluded that only existing building generators can be effective if retrofitted to be used for peak shaving or emergency back-up power.

### 3.0 BUILDINGS' DESCRIPTION

The scope of work of this Energy Savings Opportunity Survey includes the following buildings:

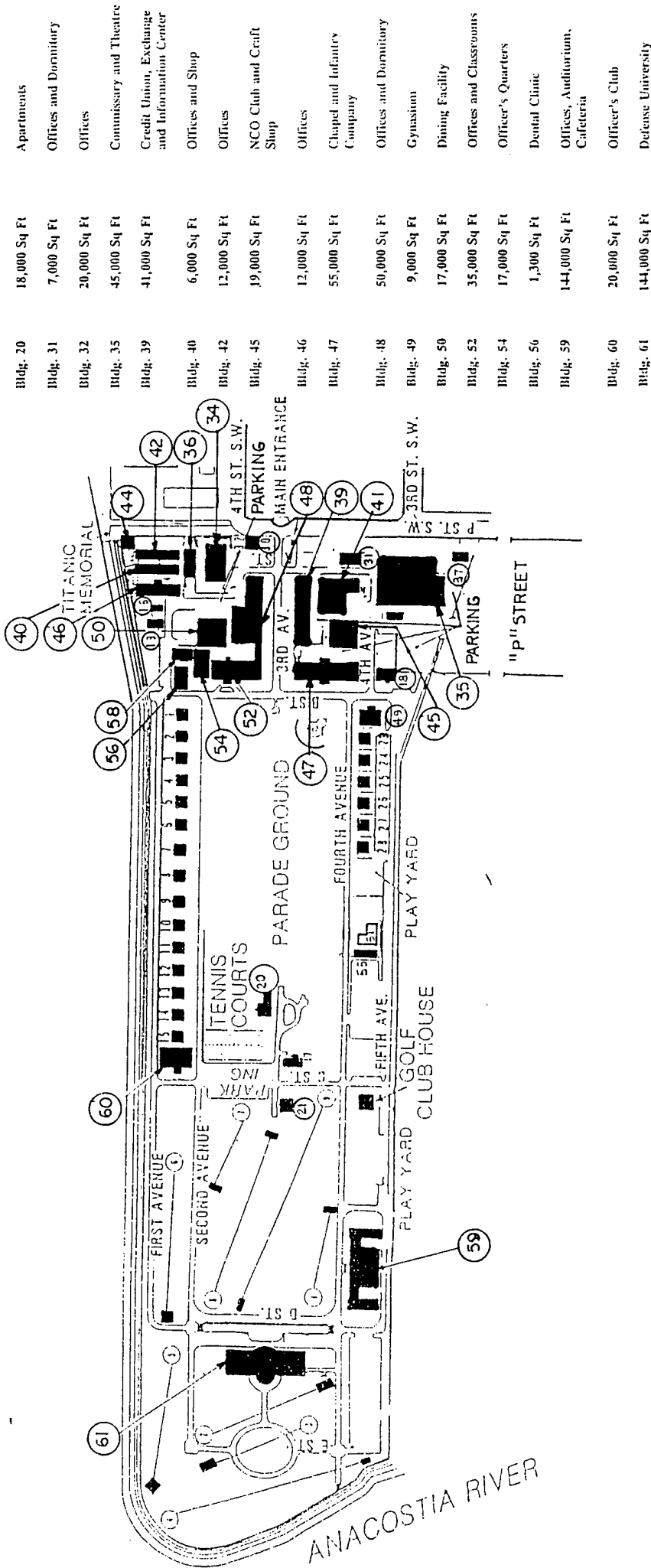
20, 31, 32, 35, 39, 40, 42, 45, 46  
47, 48, 49, 50, 52, 54, 56, 59, 60, and 61

All the buildings are of brick masonry construction. They range in area from approximately 6,000 square feet in Building 40 to about 144,000 square feet each in Building 59 and 61. Building 61 was built in 1905 as the National War College. The buildings' usage includes, but is not limited to, office areas, storage areas, recreational and physical fitness facilities, NCO and officer clubs, dormitories, dining facilities and a chapel. Buildings 59 and 61, which together account for almost 50% of the office space at the base, house the units of the National Defense University and have office areas, classroom areas, student rooms and auditoriums. A site plan showing the location of these buildings is shown on the next page.

Most of the buildings are cooled and heated, except Building 49 which has a gymnasium and has heating only. Cooling requirements are met in most cases by air-cooled chillers or by DX-split systems. Building 59 has induction units along the perimeter walls, served by an air-handling unit in the penthouse. The air handling unit has chilled water and hot water coils. Heating is almost entirely by steam from the central plant, either directly or through steam to hot water converters in all buildings. Building 48, with office areas and downstairs, has a water-based heat pump system with a water-cooled chiller as the cooling source and a converter as the heating source. Console type heat pump units are located in spaces around the building.

Lighting in all buildings is almost universally by fluorescent fixtures.

# FORT LESLEY J. McNAIR WASHINGTON D.C.



## 4.0 PRESENT ENERGY CONSUMPTION

### 4.1 Annual Energy Used

An analysis for an energy conservation project requires determination of existing energy-usage pattern. However, in the absence of any individual metering and due to a limited scope of the project the following baseline energy consumption has been established **only for the affected systems** in the respective buildings.

<u>BUILDING</u>	<u>ENERGY USAGE (MBTU/YEAR)</u>		<u>TOTAL</u>
	<u>LIGHTING SYSTEM</u>	<u>HVAC SYSTEM</u>	
20	-	839.0	839.0
31	58.6	-	58.6
32	482.5	-	482.5
35	935.2	-	935.2
39	874.2	-	874.2
40	80.1	-	80.1
42	229.2	766.8	996.0
45	155.5	-	155.5
46	341.4	-	341.4
47	683.6	-	683.6
48	1,025.8	1,566.9	2,592.7
49	294.7	-	294.7
50	210.2	-	210.2
52	620.3	-	620.3
54	145.9	-	145.9
56	40.6	-	40.6
59	2,285.4	14,275.1	16,560.5
60	392.9	-	392.9
61	1,833.3	14,255.7	16,089.0
TOTALS	10,689.4	31,703.5	42,392.9

## 4.2 Annual Energy Used

The following table summarizes the baseline energy consumption:

FUEL	SITE ENERGY MBTU/YR	SOURCE ENERGY MBTU/YR	COST \$/YR
Electricity	24,670	24,670*	216,891 <sup>+</sup>
Natural Gas	16,887	22,629**	400,037 <sup>++</sup>
Distillate Fuel	835	835	3,373
Total	42,392	48,133	620,301

\* Based on ECIP guidance of 25 April 1988 (Purchased Electric Power)

\*\* Based on site energy conversion of 1,000 btu/lb. (TM 5-838-2) and source energy conversion of 1,340 btu/lb. (ECIP guidance)

<sup>+</sup> Includes demand charges

## **5.0 ENERGY CONSERVATION ANALYSIS**

### **5.1 Energy Conservation Opportunities (ECOs) Investigated**

The energy conservation opportunities for each building were identified in the Scope of Work for this project. These opportunities are indicated below and were investigated.

#### Architectural

**Roof/Ceiling Insulation** - Add roof insulation by installing blown-in insulation to improve U-values for the roof/ceiling assembly (Building 42 only).

**Solar Film** - Install solar film on south-facing windows to reduce heat gain and hence air conditioning requirements (Building 42 only).

#### Mechanical

**Thermal Energy Storage (TES)** - TES or off-peak cooling, relies on a storage medium with high specific heat (e.g., water ice or eutectic salts) to store cooling produced during off-peak hours for utilization during peak hours. Refrigeration is provided by either conventional chillers or by industrial grade ice-making units which charge the storage tanks during off-peak hours. On-peak cooling is provided by circulating chilled liquid from storage through the buildings's air conditioning system or a heat exchanger. (Buildings 59 and 61 only.)

**Dormitory Set-back /Set-up Occupancy Sensors** - Each dormitory room in building 48 is conditioned by a console type water-to-air heat pump unit. This ECO will limit the operating hours of individual room heat pumps by automatically switching the units off when the room is not occupied. Installation of new controls will provide the winter set-back to 63° F and summer set-up to 82° F.

**Office Night Set-back/Set-up (Time Clock)** - Building 48 consists of approximately 65% office space, the remaining being utilized as 2-man dormitory rooms. The office areas occupy all of the basement, first floor, and about half of the second floor.

The office areas are served by a combination of console and ducted closet type water-to-air heat pump units. This ECO will limit the operating hours of the units by floor, automatically switching the units off at a pre-set time. A lo-limit thermostat will prevent the winter temperature from dropping below 55° F.

**Steam Convertor Insulation** - Insulate the steam convertor in the pit in building 59.

### **Electrical**

**Replace Standard Fluorescent Lamps with Energy Saving Fluorescent Lamps** - The savings in electrical energy are obtained by removing the existing standard 40 watt fluorescent lamps and replacing them with 34 watt energy saving fluorescent lamps. This allows a reduction in lighting of 6 watts per lamp. The lamp replacement can be achieved under two strategies - spot relamping or group relamping. The lamps are presently being replaced at Fort McNair under a spot relamping strategy, using standard 40 watt fluorescent tubes.

**Replace Standard Fluorescent Ballasts with Energy Efficient Ballasts** - The savings in electrical energy are obtained by removing the existing standard ballasts and replacing them with energy efficient ballasts. By using energy efficient ballasts, the wattage used by a 2-lamp standard ballast type fixture can be reduced by approximately 9 watts.

**Dimming of Fluorescent Lighting** - In those areas where the measured illumination exceeds the footcandle levels indicated in the Army guidelines in accordance with MIL-HDBK-1190, Chapter 9 and with DAEN-ECE-E, Chapter 12, the fluorescent lights can be dimmed. There are two separate strategies that can be used for dimming of the fluorescent lights:

1. Photoelectric Dimming

With photoelectric dimming, a photocell senses sunlight and compensates by dimming the fluorescent lights.

2. Static Dimming

Static dimming is applicable in those areas where the lighting levels exceed Army guidelines. The lights would be dimmed to a pre-set level.

**Install Fluorescent Fixture Reflectors** - The existing fluorescent fixtures can be retrofitted with fluorescent fixture reflectors. The fixture reflectors provide additional reflectivity in the fixture so that less light is trapped within the fixture and more light is directed toward the work surfaces. In some instances, the number of light fixtures or lamps can be reduced providing energy savings.

**Replace Incandescent Bulbs with Fluorescent Bulbs** - Although most of the buildings have primarily fluorescent lights, there are some areas where there are some incandescent lamps. These lamps can be replaced with screw in type fluorescent lamps. The energy savings are achieved by the reduction in wattage from 60-100 watts (typical) for the incandescent lamps to approximately 14.5 watts for the fluorescent screw-in lamps.

**Installation of Occupancy Sensors** - Occupancy sensors can be installed in areas where there may be unnecessary lighting of unused space. The occupancy sensor would detect when an area is unoccupied and, after a pre-determined length of time, would automatically switch the lights off. Conversely, the occupancy sensor would automatically turn on the lights when it detects an occupant in the room. For those rooms where occupancy sensors are being considered, it is estimated that an average of 20% of the time the lights could be turned off.

**Generators** - This ECO evaluates the feasibility of using diesel generators to effectively save electrical demand charges at Fort McNair by reducing the load demand at buildings 59 and 61. There are two possible alternatives that can be considered for using the generators.

Strategy I: Use generators during on-peak hours to reduce electrical demand.

Strategy II: Participate in PEPCO's Curtailable Load Program under rate schedule DC-GT, Rider GT-5.

## **5.2 Recommended ECOs**

The results of the analyses of the ECOs for various buildings are categorized into two options. Both options are basically the same with the exception that Option 1 considers lighting ECOs with standard fluorescent lamps while Option 2 considers energy saver lamps. The use of energy saver lamps precludes the use of dimming devices. The ECOs pertaining to dimming are not included in Option 2. Further, energy efficient ballasts have been evaluated using group replacement and spot replacement methods.

The feasibility of each ECO was determined on the basis of energy savings calculations (taking into account synergistic effects), investment cost estimates, and life cycle cost analysis. Savings to investment ratio (SIR) of unity, or greater, for an ECO qualifies it for implementation. The table on the next page lists the recommended ECOs in descending order of savings to investment ratio (SIR) for both options. Option-1 for all buildings is given followed by Option-2 for the same buildings.

# OPTION 1

## BUILDING 31

### LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
31-1	Replace Incandescent	123	489	6	-3	3	11.5	0.2	2/91	1993	128
31-2	Occupancy Sensors	122	40	2	-1	1	2.4	2.8	2/91	1993	127
31-3	Static Dimming	378	92	6	-3	3	1.9	3.7	2/91	1993	394
31-4	Photoelec. Dimming	105	23	2	-1	1	1.6	4.1	2/91	1993	110
31-5	Eff.Ballasts(Group)	1,737	316	5	-3	2	1.4	4.9	2/91	1993	1,812
	Eff.Ballasts (Spot)	609	91	5	-3	2	1.2	6.0	2/91	1993	635

# **BUILDING 32**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS MBTU/YEAR		SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$
				ELEC	GAS						
32-1	Replace Incandescent	619	2,619	42	-23	19	12.3	0.2	2/91	1993	646
32-2	Photoelectric Dimming	1,728	735	44	-25	19	3.1	2.1	2/91	1993	1,802
32-3	Static Dimming	2,708	1,035	60	-33	27	2.9	2.4	2/91	1993	2,824
32-4	Fixture Reflectors	7,480	2,012	119	-66	53	2.5	3.3	2/91	1993	7,802
32-5	Occupancy Sensors	122	32	2	-1	1	2.0	3.4	2/91	1993	127
32-6	Eff.Ballasts(Group)	16,453	2,977	47	-26	21	1.4	5.0	2/91	1993	17,160
	Eff.Ballasts (Spot)	5,768	851	47	-26	21	1.2	6.1	2/91	1993	6,016

# **BUILDING 35**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SJOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS		SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$
				ELEC	GAS						
					MBTU/YEAR						
						TOTAL					
35-1	Replace Incandescent	564	2,837	63	-34	29	14.5	2/91	1993	588	
35-2	Occupancy Sensors	614	311	18	-10	8	3.8	2/91	1993	640	
35-3	Fixture Reflectors	2,580	693	41	-24	17	2.5	2/91	1993	2,691	
35-4	Static Dimming	2,331	637	38	-22	16	2.1	2/91	1993	2,431	
35-5	Eff.Ballasts(Group)	25,036	4,419	72	-39	33	1.4	2/91	1993	26,113	
	Eff.Ballasts (Spot)	8,779	1,308	72	-39	33	1.2	2/91	1993	9,156	

# **BUILDING 39**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
39-1	Replace Incandescent	867	4,509	106	-56	50	15.0	0.2	2/91	1993	904
39-2	Static Dimming	1,701	588	34	-19	15	2.6	2.6	2/91	1993	1,774
39-3	Fixture Reflectors	688	186	11	-6	5	2.5	3.3	2/91	1993	718
39-4	Occupancy Sensors	1,106	352	20	-11	9	2.4	2.8	2/91	1993	1,154
39-5	Eff.Ballasts(Group)	26,733	4,805	75	-41	34	1.4	5.1	2/91	1993	27,883
	Eff.Ballasts (Spot)	9,168	1,363	75	-41	34	1.2	6.1	2/91	1993	9,562

# **BUILDING 40**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
40-1	Replace Incandescent	14	53	1	0	1	9.9	0.2	2/91	1993	15
40-2	Fixture Reflectors	429	119	7	-4	3	2.3	3.2	2/91	1993	447
40-3	Static Dimming	755	241	14	-8	6	2.2	2.8	2/91	1993	787
40-4	Occupancy Sensors	246	58	3	-2	1	1.8	3.8	2/91	1993	257
40-5	Eff.Ballasts(Group)	2,991	546	9	-5	4	1.4	5.1	2/91	1993	3,120
	Eff.Ballasts(Spot)	1,049	158	9	-5	4	1.2	6.0	2/91	1993	1,094

# BUILDING 42

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
42-1	Replace Incandescent	110	509	9	-2	7	13.4	0.2	2/91	1993	115
42-2	Static Dimming	1,133	564	29	-6	23	3.8	1.8	2/91	1993	1182
42-3	Fixture Reflectors	1204	363	19	-4	15	3.0	3.0	2/91	1993	1256
42-4	Roof Insulation	4599	568	6	70	76	2.3	7.3	2/91	1993	4798
42-5	Occupancy Sensors	122	28	1	0	1	1.9	4.0	2/91	1993	127
42-6	Eff.Ballasts(Group)	8298	1549	24	-6	18	1.5	4.8	2/91	1993	8655
	Eff.Ballasts(Spot)	2910	483	24	-6	18	1.3	5.4	2/91	1993	3035

# **BUILDING 45**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
45-1	Replace Incandescent	317	1,249	16	-9	7	11.4	0.2	2/91	1993	331
45-2	Fixture Reflectors	344	97	6	-3	3	2.6	3.2	2/91	1993	359
45-3	Eff.Ballasts(Group)	1,206	220	4	-2	2	1.4	4.8	2/91	1993	1,258
	Eff.Ballasts(Spot)	423	63	4	-2	2	1.2	6.0	2/91	1993	441

# **BUILDING 46**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
46-1	Replace Incandescent	221	937	15	-8	7	12.3	0.2	2/91	1993	231
46-2	Fixture Reflectors	1,977	555	32	-17	15	2.6	3.2	2/91	1993	2,062
46-3	Static Dimming	567	138	8	-4	4	1.9	3.7	2/91	1993	591
46-4	Occupancy Sensors	246	63	4	-2	2	2.0	3.5	2/91	1993	257
46-5	Eff.Ballasts(Group)	12,204	2,231	36	-19	17	1.4	4.9	2/91	1993	12,729
	Eff.Ballasts (Spot)	4,279	644	36	-19	17	1.2	6.0	2/91	1993	4,463

# **BUILDING 47**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
47-1	Replace Incandescent	492	1,986	28	-15	13	11.7	0.2	2/91	1993	513
47-2	Static Dimming	6,801	2,261	132	-73	59	2.5	2.7	2/91	1993	7,093
47-3	Occupancy Sensors	737	259	15	-8	7	2.6	2.6	2/91	1993	769
47-4	Fixture Reflectors	257	69	4	-2	2	2.5	3.3	2/91	1993	268
47-5	Photoelect. Dimming	366	93	6	-3	3	1.9	3.5	2/91	1993	382
47-6	Eff.Ballasts(Group)	23,589	4,287	68	-37	31	1.4	5.1	2/91	1993	24,603
	Eff.Ballasts (Spot)	8,271	1,230	68	-37	31	1.2	6.0	2/91	1993	8,627

# **BUILDING 48**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS MBTU/YEAR		SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA-LYSIS DATE	PRO-GRAM YEAR	PROG-RAM YEAR
				ELEC	GAS	TOTAL				COST \$
48-1	Replace Incandescent	737	2,840	34	-18	16	11.2	0.2	1993	769
48-2	Static Dimming	6,108	2,203	132	-79	53	2.7	2.5	1993	6371
48-3	Fixture Reflectors	945	303	15	-9	6	3.0	2.8	1993	986
48-4	Photoelec Dimming	838	323	20	-11	9	2.8	2.3	1993	874
48-5	Occupancy Sensors	1,597	523	31	-18	13	2.5	2.7	1993	1666
48-6	Night Setback - Offices	15,687	2,987	193	114	307	1.9	5.0	1993	16362
48-7	Eff. Ballasts(Group)	35,552	6,418	101	-56	45	1.4	5.1	1993	37,081
	Eff. Ballasts (Spot)	12,466	1,826	101	-56	45	1.2	6.1	1993	13,002

# BUILDING 49

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS MBTU/YEAR		SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA-LYSIS DATE	PRO-GRAM YEAR	PRO-GRAM YEAR	PROG-RAM YEAR
				ELEC	GAS						
49-1	Replace Incandescent	55	215	3	-2	1	11.2	0.2	1993	1993	57
49-2	Occupancy Sensors	122	47	3	-2	1	2.8	2.3	1993	1993	127
49-3	Photoelec. Dimming	314	106	7	-5	2	2.4	2.7	1993	1993	328
49-4	Eff.Ballasts(Group)	1.737	293	4	-3	1	1.3	5.4	1993	1993	1,812
	Eff.Ballasts(Spot)	609	73	4	-3	1	1.0	7.5	1993	1993	635

# BUILDING 50

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$	
				ELEC	GAS	TOTAL							
													MBTU/YEAR
50-1	Replace Incandescents	96	422	7	-4	3	12.8	0.2	2/91	1993		100	
50-2	Static Dimming	314	120	7	-4	3	2.9	2.4	2/91	1993		328	
50-3	Occupancy Sensors	122	24	1	-1	0	1.6	4.6	2/91	1993		127	
50-4	Photoelec Dimming	366	77	5	-3	2	1.6	4.3	2/91	1993		382	
50-5	Eff.Ballasts(Group)	6,946	1,262	20	-11	9	1.4	5.1	2/91	1993		7,245	
	Ef.Ballasts(Spot)	2,436	362	20	-11	9	1.2	6.0	2/91	1993		2,541	

# BUILDING 52

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA-LYSIS DATE	PRO-GRAM YEAR	PROG-RAM YEAR	COST \$
				ELEC	GAS	TOTAL						
52-1	Replace Incandescent	1,059	4,471	72	-39	33	12.2	0.2	2/91	1993		1,105
52-2	Occupancy Sensors	2,950	1,015	60	-36	24	2.6	2.6	2/91	1993		3,077
52-3	Static Dimming	2,330	510	31	-19	12	1.7	4.1	2/91	1993		2,430
52-4	Eff.Ballasts(Group)	19,634	3,541	56	-31	25	1.4	5.1	2/91	1993		20,478
	Eff.Ballasts (spot)	6,884	1,016	56	-31	25	1.2	6.1	2/91	1993		7,180

# **BUILDING 54**

## **LIST OF ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
54-1	Replace Incandescent	853	3,358	44	-23	21	11.4	0.2	2/91	1993	890
54-2	Static Dimming	1,133	268	16	-9	7	1.8	3.8	2/91	1993	1,182
54-3	Eff.Ballasts(Group)	3,473	632	10	-6	4	1.4	4.9	2/91	1993	3,622
	Eff.Ballasts 9Spot)	1,217	181	10	-6	4	1.2	6.1	2/91	1993	1,269

# **BUILDING 56**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
56-1	Replace Incandescent	27	108	1	-1	0	11.8	0.2	2/91	1993	28
56-2	Static Dimming	252	95	6	-3	3	2.8	2.4	2/91	1993	263
56-3	Fixture Reflectors	773	211	12	-7	5	2.6	3.3	2/91	1993	806
56-4	Eff. Ballasts(Group)	1,448	262	4	-2	2	1.4	5.1	2/91	1993	1,510
	Eff. Ballasts (Spot)	507	76	4	-2	2	1.2	6.0	2/91	1993	529

# BUILDING 59

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA-LYSIS DATE	PRO-GRAM YEAR	PROG-RAM YEAR COST \$
				ELEC	GAS	TOTAL					
59-1	Replace Incandescent	1,024	4,057	54	-30	24	11.5	0.2	2/91	1993	1,068
59-2	Steam Conv. Insulation	570	324	0	48	48	11.1	1.6	2/91	1993	595
59-3	Fixture Reflectors	2,321	656	40	-24	16	2.6	3.2	2/91	1993	2,421
59-4	Occupancy Sensors	12,536	3,567	213	-130	83	2.1	3.2	2/91	1993	13,075
59-5	Static Dimming	630	145	9	-5	4	1.8	3.9	2/91	1993	657
59-6	Eff.Ballasts(Group)	77,520	13,870	216	-123	93	1.4	5.1	2/91	1993	80,853
	Eff.Ballasts(Spot)	27,182	3,916	216	-123	93	1.1	6.2	2/91	1993	28,351

# BUILDING 60

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
60-1	Replace Incandescent	551	2,346	39	-21	18	12.3	0.2	2/91	1993	575
60-2	Occupancy Sensors	122	38	2	-1	1	2.4	2.9	2/91	1993	127
60-3	Static Dimming	1,385	312	19	-11	8	1.7	4.0	2/91	1993	1,445
60-4	Eff.Ballasts(Group)	4,293	774	12	-7	5	1.4	5.1	2/91	1993	4,478
	Eff.Ballasts(Spot)	1,505	220	12	-7	5	1.2	6.2	2/91	1993	1,570

# BUILDING 61

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
61-1	Replace Incandescent	1,298	5,293	77	-42	35	11.8	0.2	2/91	1993	1,354
61-2	Occupancy Sensors	3,810	1,469	87	-53	34	2.9	2.3	2/91	1993	3,974
61-3	Static Dimming	3,967	1,263	76	-46	30	2.4	2.8	2/91	1993	4,138
61-4	Eff. Ballasts(Group)	60,637	10,857	169	-96	73	1.4	5.1	2/91	1993	63,244
	Eff. Ballasts(Spot)	21,261	3,066	169	-96	73	1.2	6.2	2/91	1993	22,175

## OPTION 2

### BUILDING 31

#### LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$
				ELEC	GAS	TOTAL						
31-1	Replace Incandescent	123	489	6	-3	3	11.5	0.2	2/91	1993		128
31-2	Occupancy Sensors	122	38	2	-1	1	2.4	2.9	2/91	1993		127
31-3	Energy Saver Lamps	532	358	7	-4	3	1.9	1.3	2/91	1993		555
31-4	Eff.Ballasts(Group)	1,737	316	5	-3	2	1.4	4.9	2/91	1993		1,812

# **BUILDING 32**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL MBTU/YEAR					
32-1	Replace Incandescent	619	2,619	42	-23	19	12.3	0.2	2/91	1993	646
32-2	Energy Saver Lamps	4,818	3,136	60	-33	27	2.9	1.4	2/91	1993	5,025
32-3	Fixture Reflectors	8,253	1,790	107	-59	48	2.0	4.1	2/91	1993	8,608
32-4	Occupancy Sensors	614	149	9	-5	4	1.9	3.7	2/91	1993	640
32-5	Eff. Ballasts(Group)	16,453	2,977	47	-26	21	1.4	5.0	2/91	1993	17,160

# **BUILDING 35**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH)	FIRST YEAR	ENERGY SAVINGS			SIR	SIMPLE	ANA- LYSIS	PRO- GRAM	PROG- RAM
		\$	ANNUAL SAVING\$	ELEC	GAS	TOTAL MBTU/YEAR		PAY-BACK PERIOD	DATE	YEAR	YEAR
35-1	Replace Incandescent	564	2,837	63	-34	29	14.5	0.2	2/91	1993	588
35-2	Occupancy Sensors	860	352	20	-11	9	3.1	2.2	2/91	1993	897
35-3	Energy Saver Lamps	6,641	4,341	83	-46	37	3.0	1.4	2/91	1993	6,927
35-4	Fixture Reflectors	2,751	605	36	-20	16	2.1	4.1	2/91	1993	2,869
35-5	Eff. Ballasts(Group)	25,036	4,419	72	-39	33	1.4	5.1	2/91	1993	26,113

# **BUILDING 39**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
39-1	Replace Incandescent	867	4,509	106	-56	50	15.0	0.2	2/91	1993	904
39-2	Energy Saver Lamps	7,534	4,925	95	-52	43	3.0	1.4	2/91	1993	7,858
39-3	Fixture Reflectors	688	150	9	-5	4	2.1	4.1	2/91	1993	718
39-4	Occupancy Sensors	1,351	341	20	-11	9	1.9	3.6	2/91	1993	1,409
39-5	Eff. Ballasts(Group)	26,733	4,805	75	-41	34	1.4	5.0	2/91	1993	27,883

# **BUILDING 40**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$
				MBTU/YEAR								
				ELEC	GAS	TOTAL						
40-1	Replace Incandescent	14	53	1	0	1	11.0	0.2	2/91	1993		15
40-2	Energy Saver Lamps	767	504	10	-5	5	3.0	1.4	2/91	1993		800
40-3	Occupancy Sensors	246	75	3	-2	1	2.4	2.9	2/91	1993		257
40-4	Fixture Reflectors	429	96	6	-3	3	2.1	4.0	2/91	1993		447
40-5	Eff.Ballasts(Group)	2,991	546	9	-5	4	1.3	4.9	2/91	1993		3120

# **BUILDING 42**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$
				MBTU/YEAR								
				ELEC	GAS	TOTAL						
42-1	Replace Incandescent	110	509	9	-2	7	13.4	0.2	2/91	1993		115
42-2	Energy Saver Lamps	2,538	1,648	31	-18	13	2.9	1.4	2/91	1993		2,647
42-3	Roof Insulation	4,599	568	6	70	76	2.3	7.3	2/91	1993		4,798
42-4	Fixture Reflectors	1,805	388	23	-13	10	2.0	4.2	2/91	1993		1,883
42-5	Occupancy Sensors	122	22	1	-1	0	1.4	5.0	2/91	1993		127
42-6	Eff.Ballasts(Group)	8,298	1,549	24	-6	18	1.5	4.8	2/91	1993		8,655

# BUILDING 45

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
45-1	Replace Incandescent	317	1,249	16	-9	7	11.4	0.2	2/91	1993	331
45-2	Energy Saver Lamps	362	239	5	-3	2	3.0	1.4	2/91	1993	378
45-3	Fixture Reflectors	344	78	5	-3	2	2.1	4.0	2/91	1993	359
45-4	Eff.Ballasts(Group)	1,206	220	4	-2	2	1.4	4.8	2/91	1993	1,258

# **BUILDING 46**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
46-1	Replace Incandescent	221	937	15	-8	7	12.3	0.2	2/91	1993	229
46-2	Energy Saver Lamps	3,041	2,005	39	-21	18	3.0	1.4	2/91	1993	3,172
46-3	Fixture Reflectors	1,997	447	26	-14	12	2.1	4.0	2/91	1993	2,062
46-4	Occupancy Sensors	246	53	3	-2	1	1.7	4.2	2/91	1993	257
46-5	Eff. Ballasts(Group)	12,220	2,231	36	-19	17	1.4	4.9	2/91	1993	12,729

# **BUILDING 47**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR	COST \$	
				ELEC	GAS	TOTAL							
													MBTU/YEAR
47-1	Replace Incandescent	492	1,986	28	-15	13	11.7	0.2	2/91	1993		513	
47-2	Energy Saver Lamps	7,217	4,718	91	-50	41	3.0	1.4	2/91	1993		7,527	
47-3	Occupancy Sensors	737	220	13	-7	6	2.3	3.0	2/91	1993		769	
47-4	Fixture Reflectors	860	189	11	-6	5	2.1	4.1	2/91	1993		897	
47-5	Eff.Ballasts(Group)	23,589	4,287	68	-37	31	1.4	5.0	2/91	1993		24,603	

# BUILDING 48

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
48-1	Replace Incandescent	737	2,840	34	-18	16	11.2	0.2	2/91	1993	769
48-2	Energy Saver Lamps	10,552	6,839	130	-73	57	2.9	1.4	2/91	1993	11,006
48-3	Occupancy Sensors	1,843	538	31	-18	13	2.2	3.1	2/91	1993	1,922
48-4	Fixture Reflectors	945	203	12	-7	5	2.0	4.2	2/91	1993	986
48-5	Night Setback - Offices	15,687	2,987	193	114	307	1.9	5.0	2/91	1993	16362
48-6	Eff.Ballasts(Group)	35,552	6,418	101	-56	45	1.4	5.0	2/91	1993	37,081

# BUILDING 49

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH)	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS MBTU/YEAR			SIR	SIMPLE PAY-BACK PERIOD YEAR	ANALYSIS DATE	PROGRAM YEAR	PROGRAM YEAR COST \$
				ELEC	GAS	TOTAL					
49-1	Replace Incandescent	55	215	3	-2	1	11.3	0.2	2/91	1993	57
49-2	Energy Saver Lamps	532	326	6	-4	2	2.8	1.5	2/91	1993	555
49-3	Occupancy Sensors	122	30	2	-2	0	1.8	3.7	2/91	1993	127
49-4	Fixture Reflectors	257	45	3	-2	1	1.6	5.1	2/91	1993	268
49-5	Eff.Ballasts(Group)	1,737	293	4	-3	1	1.3	5.3	2/91	1993	1,812

# **BUILDING 50**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
50-1	Replace Incandescents	96	422	7	-4	3	12.8	0.2	2/91	1993	100
50-2	Energy Saver Lamps	2,125	1,388	27	-15	12	2.9	1.4	2/91	1993	2,216
50-4	Eff.Ballasts(Group)	6,946	1,262	20	-11	9	1.4	5.0	2/91	1993	7,245

# BUILDING 52

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
52-1	Replace Incandescent	1,059	4,471	72	-39	33	12.2	0.2	2/91	1993	1,105
52-2	Energy saver Lamps	3,689	2,395	46	-25	21	2.9	1.4	2/91	1993	3,848
52-3	Occupancy Sensors	2,704	843	49	-27	22	2.4	2.9	2/91	1993	2,820
52-4	Eff.Ballasts(Group)	19,634	3,541	56	-31	25	1.4	5.0	2/91	1993	20,748

# **BUILDING 54**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
54-1	Replace Incandescent	853	3,358	44	-23	21	11.4	0.2	2/91	1993	890
54-2	Energy Saver Lamps	192	125	2	-1	1	2.9	1.4	2/91	1993	200
54-3	Eff. Ballasts(Group)	3,473	632	10	-6	4	1.4	4.9	2/91	1993	3,662

# BUILDING 56

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH)	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY-BACK PERIOD YEAR	ANA-LYSIS DATE	PRO-GRAM YEAR	PRO-GRAM YEAR	COST \$
				ELEC	GAS	TOTAL						
56-1	Replace Incandescent	27	108	1	-1	0	11.6	0.2	2/91	1993		28
56-2	Energy Saver Lamps	443	290	6	-3	3	3.0	1.4	2/91	1993		462
56-3	Fixture Reflectors	773	170	10	-6	4	2.1	4.1	2/91	1993		806
56-4	Eff. Ballasts(Group)	1,448	262	4	-2	2	1.4	5.0	2/91	1993		1,510

# BUILDING 59

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				ELEC	GAS	TOTAL					
59-1	Replace Incandescent	1,024	4,057	54	-30	24	11.5	0.2	2/91	1993	1,068
59-2	Steam Conv. Insulation	570	324	0	48	48	11.1	1.6	2/91	1993	595
59-3	Energy saver Lamps	20,249	13,066	249	-142	107	2.9	1.4	2/91	1993	21,120
59-4	Occupancy Sensors	12,536	3,773	222	-127	95	2.3	3.0	2/91	1993	13,075
59-5	Fixture Reflectors	2,493	543	33	-19	14	2.0	4.1	2/91	1993	2,600
59-6	Eff. Ballasts(Group)	77,520	13,870	216	-123	93	1.4	5.0	2/91	1993	80,853

# **BUILDING 60**

## **LIST OF RECOMMENDED ECO'S**

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVING\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
60-1	Replace Incandescent	551	2,346	39	-21	18	12.3	0.2	2/91	1993	575
60-2	Energy Saver Lamps	664	431	8	-5	3	2.9	1.4	2/91	1993	693
60-3	Occupancy Sensors	122	31	2	-1	1	1.9	3.5	2/91	1993	127
60-4	Eff.Ballasts(Group)	4,293	774	12	-7	5	1.4	5.0	2/91	1993	4,478

# BUILDING 61

## LIST OF RECOMMENDED ECO'S

ECO #	DESCRIPTION	COST (incl. SIOH) \$	FIRST YEAR ANNUAL SAVINGS\$	ENERGY SAVINGS			SIR	SIMPLE PAY- BACK PERIOD YEAR	ANA- LYSIS DATE	PRO- GRAM YEAR	PROG- RAM YEAR COST \$
				MBTU/YEAR							
				ELEC	GAS	TOTAL					
61-1	Replace Incandescent	1,298	5,293	77	-42	35	11.8	0.2	2/91	1993	1,354
61-2	Energy Saver Lamps	14,714	9,451	178	-101	77	2.9	1.4	2/91	1993	15,347
61-3	Occupancy Sensors	3,072	1,086	64	-36	28	2.7	2.5	2/91	1993	3,204
61-4	Eff.Ballasts(Group)	60,637	10,857	169	-96	73	1.4	5.0	2/91	1993	63,244

## 6.0 ENERGY AND COST SAVINGS

The following table presents the estimated energy usage patterns and costs before and after the implementation of the recommended ECOs.

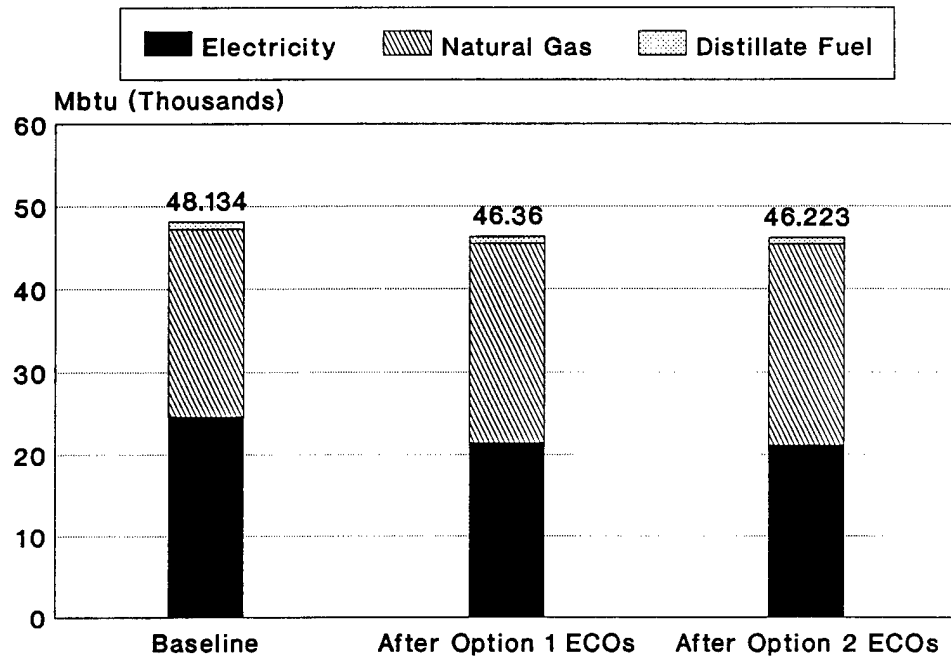
### OPTION 1

	Existing Energy & Cost	Energy and Cost After Implementation of ECOs	Savings After Implementation	
			%	Savings
Source Energy Consumption				
Electricity MBtu	24,670	21,457	13.0	3,213
Natural Gas MBtu	22,629	24,076	(6.4)	(1,447)
Distillate Oil Mbtu	835	835	0	0
Total Mbtu	48,134	46,368	3.7	1,766
Site Energy Consumption				
Total MBtu	42,392	40,187	5.2	2,432
Energy Costs				
Per/year	\$620,301	\$579,361	6.6	\$40,940

### OPTION 2

	Existing Energy & Cost	Energy and Cost After Implementation of ECOs	Savings After Implementation	
			%	Savings
Source Energy Consumption				
Electricity MBtu	24,670	21,128	14.3	3,542
Natural Gas MBtu	22,629	24,260	(7.2)	(1,631)
Distillate Oil	835	835	0	0
Total MBtu	48,134	46,223	4.0	1,911
Site Energy Consumption				
Total MBtu	42,392	40,061	5.5	2,610
Energy Costs				
Per/year	\$620,301	\$556,894	10.3	\$63,812

## Energy Usage By Fuel



## 7.0 ENERGY PLAN

The following categories of programs are available for the recommended ECOs:

Energy Conservation Investment Program (ECIP): This program is for projects which have a construction cost estimate greater than \$200,000, a savings to investment ratio (SIR) greater than one and a simple payback period of ten years or less.

Productivity Capital Investment Programs (PCIP): The projects that do not qualify for ECIP fall into the category of Productivity Capital Investment Programs (PCIP). The following categories of PCIP programs are available for the recommended ECOs:

1. Quick Return in Investment Program (QRIP): This program is for projects which have a total cost of less than \$100,000 and a simple payback period of two years or less. Three year procurement (AMMO and OPA) appropriations are available for this program.
2. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a cost greater than \$100,000 and a simple payback period of four years or less. Projects under this program must be pre-identified two fiscal years in advance.
3. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a cost greater than \$100,000 and simple payback period of four years or less. The projects under this program require MCA funding. Because of the difficulty in obtaining MCA funding, implementation under this program has not been considered.

Considering the availability of the above programs, the following packages have been prepared for each option.

## OPTION 1

1. ECIP - Following projects will qualify under this program. Completion of DD Form 1391c and supporting data will be required.

ECO DESCRIPTION	BUILDING NO.	COST (INCL. SIOH) FY 1991	Program Year 1993
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 9,054	\$ 9,443
Static Dimmers	31, 32, 35, 39, 40, 42, 46, 47, 48, 50, 52, 54, 56, 59, 60, and 61	\$ 32,494	\$33,891
Photo-Electric Dimmers	31, 32, 47, 48, 49, and 50	\$ 3,682	\$ 3,841
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 56, and 59	\$ 19,001	\$19,818
Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49 50, 52, 60, 59 and 61	\$ 24,574	\$25,631
Energy-Efficient Ballasts (Spot Replacement)	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$115,321	\$120,280
Roof Insulation	42	\$ 4,599	\$ 4,797
Night Setback	48	\$ 15,687	\$ 16,362
Steam Convertor Insulation	59	\$ 570	\$ 594
<b>TOTAL</b>		<b>\$224,982</b>	<b>\$234,657</b>

2. **QRIP** - Following projects will qualify under this program. Completion of Form 5108-1-R and supporting data will be required.

ECO DESCRIPTION	BUILDING NO.	FY 1991	COST (INCL. SIOH)
			Program Year 1993
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60 and 61	\$ 9,054	\$ 9,443
Static Dimmers	31, 32, 35, 39, 40, 42, 46, 47, 48, 50, 52, 54, 56, 59, 60, and 61	\$32,494	\$33,891
Photo-Electric Dimmers	31, 32, 47, 48, 49, and 50	\$ 3,682	\$ 3,841
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 56 and 59	\$19,001	\$19,818
Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49 50, 52, 59, 60 and 61	\$24,574	\$25,631
Roof Insulation	42	\$ 4,599	\$4,797
Steam Convertor Insulation	59	\$ 570	\$594
<b>TOTAL</b>		<b>\$93,974</b>	<b>\$98,015</b>

3. **PECIP**: All recommended ECOs would qualify under this program. Completion of Form 5108-1-R and supporting data will be required. The project must be identified two fiscal years in advance. Following is a summary of the ECOs in various buildings:

ECO DESCRIPTION	BUILDING NO.	COST (INCL. SIOH)	
		FY 1991	Program Year 1993
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 9,054	\$ 9,443
Static Dimmers	31, 32, 35, 39, 40, 42, 46, 47, 48, 50, 52, 54, 56, 59, 60, and 61	\$ 32,494	\$33,891
Photo-Electric Dimmers	31, 32, 47, 48, 49, and 50	\$ 3,682	\$ 3,841
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 56, and 59	\$ 19,001	\$19,818
Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49 50, 52, 60, 59 and 61	\$ 24,574	\$25,631
Energy-Efficient Ballasts (Group Replacement)	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$328,895	\$343,037
Roof Insulation	42	\$ 4,599	\$ 4,797
Night Setback	48	\$ 15,687	\$ 16,362
Steam Convertor Insulation	59	\$ 570	\$ 594
TOTAL		\$438,556	\$457,414

## OPTION 2

1. **PECIP:** All recommended ECOs would qualify under this program. Completion of Form 5108-1-R and supporting data will be required. The project must be identified two fiscal years in advance. Following is a summary of the ECOs in various buildings:

ECO DESCRIPTION	BUILDING NO.	COST (INCL. SIOH)	
		FY 1991	Program Year 1993
Replace incandescent lamps w/fluorescent	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$ 9,054	\$ 9,443
Energy Saver Lamps	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$86,609	\$90,333
Fixture Reflectors	32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 56, and 59	\$21,580	\$22,508
Occupancy Sensors	31, 32, 35, 39, 40, 42, 46, 47, 48, 49, 50, 52, 60, and 61	\$24,699	\$25,761
Energy-Efficient Ballasts (Group Replacement)	31, 32, 35, 39, 40, 42, 45, 46, 47, 48, 49, 50, 52, 54, 56, 59, 60, and 61	\$328,895	\$343,037
Roof Insulation	42	\$ 4,599	\$4,797
Night Setback	48	\$ 15,687	\$ 16,362
Steam Convertor Insulation	59	\$ 570	\$594
<b>TOTAL</b>		<b>\$491,693</b>	<b>\$512,835</b>

## 8.0 MAINTENANCE AND REPAIR

Generally, all the buildings surveyed appear to have a good level of maintenance. In addition, the equipment and the equipment rooms are neat and clean, which in itself is a sign of good maintenance. Some items that require corrective action are described in the narrative for each building. Major maintenance, repair and operational items are:

1. Check the indoor and outdoor reset for the various buildings and set the system in operation with proper reset schedules.
2. Set night setback controls in proper operation after checking and repairing them.
3. Evaluate the outside air requirements in various buildings and set the dampers to provide new levels of outside air.

The implementation of these measures will have a major effect on energy usage by resulting in a reduced energy budget for the post.